

WHAT IS CLAIMED IS:

1. A diffusion layer for a fuel cell comprising at least a base layer, wherein said base layer only is increased in strength.

2. A method for manufacturing a diffusion layer including at least a base layer for a fuel cell comprising the steps of:

providing said base layer,

wherein said base layer only is increased in strength during providing the base layer.

3. An apparatus for manufacturing a diffusion layer including at least a base layer for a fuel cell comprising:

a device for providing a base layer,

wherein said base layer only is increased in strength.

4. A diffusion layer for a fuel cell comprising:

a base layer; and

a water-repellent layer coated on said base layer,

wherein only either one of said base layer and said water-repellent layer is increased in strength.

5. A diffusion layer according to claim 4, wherein said water-repellent layer only is increased in strength.

6. A method for manufacturing a diffusion layer for a fuel cell comprising the steps of;

providing a base layer; and

coating a water-repellent layer on said base layer,

wherein only either one of said base layer and said water-repellent layer is increased in strength during a respective one of said base layer providing step and said water-repellent layer coating step.

7. A method for according to claim 6, wherein said water-repellent layer only is increased in strength during said water-repellent layer coating step.

8. An apparatus for manufacturing a diffusion layer for a fuel cell comprising:

a first device for providing a base layer; and

a second device for coating a water-repellent layer on said base layer,

wherein only either one of said base layer and said water-repellent layer is increased in strength by a respective one of said first device and said second device.

9. An apparatus according to claim 8, wherein said water-repellent layer only is increased in strength by said second device.

10. A diffusion layer for a fuel cell comprising:

a base layer,

said base layer including: (a) a carbonized yarn of a woven fabric, and (b) a

carbonized binder impregnated into the yarn thereby connecting filaments of the yarn.

11. A method for manufacturing a diffusion layer for a fuel cell comprising the steps of:

impregnating a base layer constructed of a woven fabric with a synthetic resin binder; and

carbonizing said base layer and said binder impregnated into said base layer.

12. An apparatus for manufacturing a diffusion layer for a fuel cell comprising:

a binder impregnation treatment container for containing a dissolved binder to be impregnated into a base layer constructed of a woven fabric; and

a carbonizing furnace for carbonizing the base layer and the binder impregnated into the base layer.

13. A diffusion layer for a fuel cell comprising:

a base layer,

said base layer including: (a) a carbonized yarn constructed of a woven fabric, and (b) a conductive synthetic resin binder impregnated into the carbonized yarn thereby connecting filaments of the yarn, said binder being solidified and non-carbonized.

14. A method for manufacturing a diffusion layer for a fuel cell comprising

the steps of:

carbonizing a base layer constructed of a woven fabric;
impregnating the carbonized base layer with a conductive synthetic resin
binder; and
solidifying said conductive synthetic resin binder impregnated into said base
layer.

15. An apparatus for manufacturing a diffusion layer for a fuel cell
comprising:

a carbonizing furnace for carbonizing a base layer constructed of a woven
fabric;
a binder impregnation treatment container for containing a dissolved
conductive synthetic resin binder to be impregnated into said carbonized base layer;
and
a furnace for solidifying said binder.

16. A diffusion layer for a fuel cell comprising:
a base layer having a water-repellent characteristic,
said base layer including: (a) a carbonized yarn constructed of a woven
fabric, and (b) a non-conductive synthetic resin binder impregnated into the
carbonized yarn thereby connecting filaments of the yarn, said binder being
solidified and non-carbonized.

17. A method for manufacturing a diffusion layer for a fuel cell comprising

the steps of:

carbonizing a base layer constructed of a woven fabric;
impregnating the carbonized base layer with a non-conductive synthetic resin binder selected from a group consisting of fluororesin and silicone resin; and
solidifying said non-conductive synthetic resin binder impregnated into said base layer.

18. An apparatus for manufacturing a diffusion layer for a fuel cell comprising:

a carbonizing furnace for a base layer constructed of a woven fabric;
a binder impregnation treatment container for containing a dissolved non-conductive synthetic resin binder to be impregnated into the carbonized base layer;
and
a furnace for solidifying the binder.

19. A diffusion layer for a fuel cell comprising:

a base layer,
said base layer including: (a) a non-woven carbon paper made from carbon fibers, and (b) a synthetic carbonized resin binder impregnated into the carbon paper with a nonuniform distribution in an impregnation amount, wherein
a first portion of said base layer including a relatively large amount of the binder is impregnated constructing a rigid portion of said base layer and a second portion of said base layer including a relatively small amount of the binder is impregnated constructing a deformable portion of said base layer.

20. A method for manufacturing a diffusion layer for a fuel cell comprising the steps of:

impregnating a base layer of a non-woven carbon paper made from carbon fibers in a wet condition with a synthetic resin binder so that said binder has a nonuniform distribution in an impregnation amount; and
carbonizing said binder impregnated into said base layer.

21. An apparatus for manufacturing a diffusion layer for a fuel cell comprising:

a synthetic resin binder impregnating device for impregnating a base layer of a non-woven carbon paper made from carbon fibers in a wet condition with a synthetic resin binder so that said binder has a nonuniform distribution in an impregnation amount; and

a carbonizing furnace for carbonizing said binder impregnated into said base layer.

22. A diffusion layer for a fuel cell comprising:

a non-woven base layer made in a dry condition and a synthetic resin binder impregnated into an entire range of said base layer, said base layer and said impregnated binder being pressed and then completely carbonized.

23. A method for manufacturing a diffusion layer for a fuel cell comprising the steps of:

impregnating a non-woven base layer made in a dry condition with a

synthetic resin binder;

pressing said base layer impregnated with said synthetic resin binder; and

carbonizing completely said base layer and said synthetic resin binder
impregnated into said base layer.

24. An apparatus for manufacturing a diffusion layer for a fuel cell
comprising:

a synthetic resin binder impregnating device for impregnating a non-woven
base layer made in a dry condition with a synthetic resin binder;

a press device for pressing said base layer impregnated with said synthetic
resin binder; and

a carbonizing furnace for completely carbonizing said base layer and said
synthetic resin binder impregnated into said base layer.

25. A diffusion layer for a fuel cell comprising:

a base layer having opposite surfaces; and

a water-repellent layer made from a mixture of carbon and synthetic resin
formed on one surface of said base layer, said water-repellent layer being
constructed of a multi-layer structure including an inner layer and an outer layer
different in adhesiveness and strength to each other, said inner layer having a
strength greater than a strength of said outer layer, said outer layer having an
adhesiveness stronger than an adhesiveness of said inner layer.

26. A method for manufacturing a diffusion layer for a fuel cell comprising

the steps of:

repeating a plurality of times a process comprising the steps of:

coating a layer made from a mixture of carbon and synthetic resin;

and

solidifying said layer, a solidifying condition being different between respective processes.

27. The method according to claim 26, further comprising the steps of:

coating a first water-repellent layer made from a mixture of carbon and synthetic resin on a carbon base layer and then solidifying said first water-repellent layer at a first temperature higher than a melting temperature of said synthetic resin; and

coating a second water-repellent layer made from a mixture of said carbon and said synthetic resin on said first water-repellent layer and then solidifying said second water-repellent layer at a second temperature near said melting temperature of said synthetic resin.

28. An apparatus for manufacturing a diffusion layer for a fuel cell comprising:

a furnace for solidifying a first water-repellent layer made from a mixture of carbon and synthetic resin coated on a carbon base layer at a first temperature higher than a melting temperature of said synthetic resin and for solidifying a second water-repellent layer made from a mixture of said carbon and said synthetic resin coated on said first water-repellent layer at a second temperature near said melting temperature

of said synthetic resin.

29. A diffusion layer for a fuel cell comprising:

a water-repellent layer including two kinds of binders.

30. The diffusion layer according to claim 29, wherein said two kinds of binders include a first binder made from a synthetic resin having an adhesiveness and a second binder made from material having a higher rigidity than said synthetic resin of said first binder.

31. A method for manufacturing a water-repellent layer of a diffusion layer for a fuel cell comprising the steps of:

coating a mixture of carbon and two kinds of binders dissolved in solvent on a base layer of said diffusion layer; and

solidifying said mixture coated on said base layer at a temperature near a melting temperature of one of said binders.

32. The method according to claim 31, wherein the coating step further comprises:

coating said mixture including said two kinds of binders on said base layer of said diffusion layer, said two kinds of binders including a first binder made from a synthetic resin having an adhesiveness and a second binder made from material having a greater rigidity than said first binder; and the solidifying step further comprises:

solidifying said mixture coated on said base layer at a temperature near a melting temperature of said first binder.

33. An apparatus for manufacturing a diffusion layer for a fuel cell comprising:

a furnace for solidifying a water-repellent layer made from a mixture of carbon and two kinds of binders and coated on a base layer of said diffusion layer at a temperature near a melting temperature of one of said two kinds of binders.

34. A diffusion layer for a fuel cell comprising:

a base layer; and

a water-repellent layer coated on said base layer, said water-repellent layer being made from a mixture of carbon and synthetic resin and solidified, said synthetic resin being deformed into filaments by applying a shear force to said mixture before coating of said mixture onto said base layer.

35. A method for manufacturing a diffusion layer for a fuel cell comprising the steps of:

applying a shear force to a paste including carbon and synthetic resin;

coating said paste on a base layer of said diffusion layer; and

solidifying said paste coated on said base layer at a temperature near a melting temperature of said synthetic resin.

36. An apparatus for manufacturing a diffusion layer for a fuel cell

comprising:

a mixer for applying a shear force to a paste including carbon and synthetic resin;

a coating device for coating said paste on a base layer of said diffusion layer; and

a furnace for solidifying said paste coated on said base layer at a temperature near a melting temperature of said synthetic resin.

37. A diffusion layer for a fuel cell comprising:

a base layer; and

a water-repellent layer coated on said base layer, said water-repellent layer being made from a mixture of carbon and synthetic resin and solidified, said synthetic resin being deformed into filaments by applying a shear force to said water-repellent layer after solidifying said water-repellent layer.

38. A method for manufacturing a diffusion layer for a fuel cell comprising the steps of:

coating a paste for a water-repellent layer on a base layer of said diffusion layer, said paste including carbon and synthetic resin;

solidifying said paste coated on said base layer at a temperature near a melting temperature of said synthetic resin, and

applying a shear force to said water-repellent layer by causing said base layer and said water-repellent layer to pass between a pair of rollers which generate a stress directed in a width direction of said base layer in said water-repellent layer.

39. An apparatus for manufacturing a diffusion layer for a fuel cell comprising:

- a coating device for coating a paste including carbon and synthetic resin on a base layer of said diffusion layer;
- a furnace for solidifying said paste coated on said base layer at a temperature near a melting temperature of said synthetic resin; and
- a pair of rollers for applying a shear force to the paste solidified when said solidified paste and said base layer are caused to pass between said pair of rollers.